mograph was not disturbed during November and December.

Friday, November 25, at the following stations in Virginia: Bedford City, Bonair, Buckingham, Colmans Falls, Fredericksburg, Blacksburg, Burkes Garden, Grahams Forge, Lexington. On this date, November 25, shocks were also felt at the following places: Pulaski, Va., a slight shock, lasting half a minute, at 3:10 p. m.; Radford, Va., a distinct shock, lasting ten or twelve seconds, at 3:05; Wytheville, Va., alarming, twenty seconds duration, at 3:10; Roanoke, Va., plainly felt; Lynchburg, Va., duration fifteen or twenty seconds, at a few minutes past three; Danville, Va., duration five seconds, at 3:07; Norfolk, Va., two very slight shocks at a few minutes after three; Winston, N. C., distinct, at 3:10 p. m.; Franklinsville, N. C., very distinct, at 3:05 p. m.; Charlotte, N. C. distinct, at 3:10 p. m.; Oakvale, W. Va., very severe, lasting about twenty seconds, at 3:08 p. m.

Professor Marvin reports that the seismograph belonging to the Weather Bureau was moved from one room to an adjoining one during November, and was reinstalled apparently just at the right time to give a very satisfactory record of the earthquake of Friday, November 25. The instrument shows that the tremor reached Washington, D. C., at exactly 3 h., 10 m., 30 s., p. m., seventy-fifth meridian time. In addition to Professor Marvin's seismograph, the only other observation in Washington was made by Mrs. N. G. Sprague, No. 705 Mount Vernon Square, N. W., who reports, "A lounge rocked slightly at 3:10 p. m. for less than half a minute."

Mr. R. D. Buford, of the clerk's office, Bedford City, Va., reports through the Chief of the United States Geological Survey, an account of earth tremors on the farm of Mr. Henry Creasy, near Otter Hill, Bedford Co., which have continued almost constantly for more than a year. The tremors in the valley of New River were the subject of a special investigation by Mr. N. R. Campbell, of the Geological Survey, in 1897. His report will give all necessary information to those interested in the subject. These tremors apparently arise from the sliding of the stratified layers of rocks over each other; they are in a state of great strain, and are continually cracking and sliding; the individual motions are extremely small in the case of slight tremors, and only amount to a few feet in the case of the heaviest earthquake.

THE MOON AND THE WEATHER.

The Editor has been requested to remark upon some special ideas with regard to the relation of the moon to the weather.

A gentleman at Huntington, Ind., states, as a general observation, that—

> The position of the moon at new moon forecasts the temperature for the following lunar month. Thus, on June 18, 1898, the new moon occurred 25° farther north than on July 18, and much farther than on August 17. Has this northing any special relation to the weather?

The Editor must answer, "No." Every careful study of suspected relations between the moon and the weather has shown that there are none. The same lunar phenomenon that is said to produce cold or rain in one part of the world is said to produce just the opposite somewhere else. The moon is too cold to radiate much heat, so that all phenomena that involve heat must depend upon the sun. True, the moon has an attractive power and can cause tides in the ocean as important as those caused by the sun, but that has little to do with our atmosphere. The atmospheric tides have not yet been shown to be important.

UNEQUAL DISTRIBUTION OF SNOW.

Having noticed the marked discrepancy between the depth of snow at Plattsburg, N. Y., and adjacent stations, further information was solicited from section director, Mr. R. G. Allen, who states that—

> There has been no snow this season (up to December 19) at Plattsburg or along the Champlain Valley, except flurries, while west of Lake Champlain, say 15 miles, snow is from 12 to 20 inches in depth.

RECENT METEORS.

November.—The occurrence of the November shower of meteors seems to have tempted active newspaper correspondents to add their own unnecessary exaggerations to the great stories reported by the ship captains. Thus, Captain Gartel, of the bark *Quevilly*, which arrived at Philadelphia November 25, and sailed away a few days later, stated that on November 15 a huge meteor flashed out of the heavens and fell with a tremendous splash directly in the path of the vessel. The numerous other details published in the Philadelphia papers are generally considered to be the invention of the newspaper reporter. We should probably discredit the whole story had we not a similar report from Capt. H. C. McCallum, master of the barge *Masaba*, of the Minnesota Steamship Company. Over his own signature he writes from Two Harbors, Minn., to the Weather Bureau, as follows:

> I, with my second mate, wheelsman, and lookout, saw a meteor fall from the heavens Monday, about 11 o'clock p. m., November 14.
>
> We were about 20 miles east of Standard Rock, steering west, and this meteor was due west, or dead ahead when it fell. It was blowing a gale from the west-southwest at the time. It gave me quite a start and also a scare at the time; never saw anything like it before, and for my part never want to see one again. It was about the size of an oil barrel and lit up the heavens, it being white with colors on the edges.
>
> Captain Morgan of the *Marina* saw it; he was abreast of Copper Harbor, Mich., and it fell in the direction of Houghton, Mich., at about 11 o'clock, so it must have fallen somewhere in that vicinity, as we were 50 or 60 miles due east of Houghton and on a line with the fall of the meteor.

As there is nothing at all impossible in the fall of a meteor into the ocean or the Great Lakes, we may probably give credence to the two reports above quoted.

A report from Perry, Okla., to the effect that several meteors fell near that place about 11 o'clock p. m., November 13, proves to be entirely false. It is denounced with indignation by Oklahoma papers, and is reported to be untrue by our own section director. As the report was widely copied the Editor is obliged to warn students of meteorites against accepting it.

December 2.—On the morning of December 2, after daylight, a meteor one-fourth as large as the full moon, with a long scintillating train, the head being as bright as an arc light, was seen by many persons at Cumberland, Md. Mr. Howard Shriver states that it moved in a northerly direction and disappeared beyond the right-hand peak of the Narrows.

An equally remarkable meteor seems to have been seen elsewhere. A report comes from Randall, Kans. (39° 45′ N., 98° 2′ W.), to the effect that a huge meteorite fell on the evening of December 2, but further inquiry has failed to confirm this story.

The exact height and path of a bright meteor like this can only be determined when various observers note the apparent angular azimuth and altitude of at least two points in the path as seen by each. The two best points to observe are the end or disappearance of the meteor and the position when nearest the observer's zenith.

OPTICAL PHENOMENA.

Mr. Howard Shriver, of Cumberland, Md., describes a beautiful optical effect. He states that when the twigs of a tree are fine and close, the light from an electric arc lamp shining

between them appears to an observer to form complete rings or concentric bands of brightly colored lights. To some observers the smallest circle at the center appears to be nearer the eye and the larger circle nearer the light; to other observers the opposite appears to be the case.

Several attempts at an explanation have been made in the Cumberland newspapers, but we think the truth is that the circles of light are produced by the optical action called interference of the waves of light. A beam of light, as analyzed by a prism, is said to be composed of an almost infinite number of waves which are exceedingly short and oscillate with great rapidity. The slower oscillations produce red and yellow lights while the most rapid oscillations produce blue and violet lights. If we pick out a single set of homogeneous waves producing yellow light, for instance, we find that as these attempt to pass by the edges of the twigs, or any other object, they curve around the edge and are said to be inflected or diffracted very much as waves of water or of sound curve around any obstacle. The wave that curves around one edge of a twig will interfere with the one that curves around the other edge, and as they both pass on they intersect and interfere with each other so that there are places in the path of each wave where one neutralizes the other, producing darkness. Midway between these bright regions are others where they reinforce each other producing greater brightness. These dark and bright places are arranged in circles around the central line of sight from the eye to the arc light. The circles made by the blue rays are a little smaller than those made by yellow or red light, therefore, with ordinary light the eye usually perceives concentric bluish and reddish rings if these are not overpowered by the yellow ones.

This phenomenon was first studied by Sir Isaac Newton (who thought that light was the effect of minute atoms shot in straight lines from the sun to the earth), and he explained it, as well as the colors of the soap bubble, by assuming that the atoms had "fits of easy reflection." But modern students have been better satisfied with the wave theory of light and the interference of waves as described above.

We shall not attempt to explain why some observers imagine the smallest, central circles farther off than the larger outward ones, while others imagine the contrary. This is a so-called subjective phenomenon and its study belongs to psychology. In an instrument for determining the average diameter of the fibres of wool, hair, cotton, etc., this same principle was made use of early in this century, before the microscope was brought to its present degree of perfection.

METEOROLOGICAL TABLES AND CHARTS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table IV gives, for 26 stations selected out of 113 that maintain continuous records, the mean hourly temperatures deduced from the Richard thermographs described and figured in the Report of the Chief of the Weather Bureau, 1891–92, p. 29.

Table V gives, for 26 stations selected out of 104 that maintain continuous records, the mean hourly pressures as automatically registered by Richard barographs, except for Washington, D. C., where Foreman's barograph is in use. Both instruments are described in the Report of the Chief of the Weather Bureau, 1891–92, pp. 26 and 30.

Table VI gives, for about 130 stations, the arithmetical means of the hourly movements of the wind ending with the respective hours, as registered automatically by the Robinson anemometer, in conjunction with an electrical recording mechanism, described and illustrated in the Report of the Chief of the Weather Bureau, 1891–92, p. 19.

Table VII gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table VIII gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table IX gives, for about 70 stations, the average hourly sunshine (in percentages) as derived from the automatic records made by two essentially different types of instruments, designated, respectively, the thermometric recorder and the photographic recorder. The kind of instrument used at each station is indicated in the table by the letter T or P in the column following the name of the station.

Table X gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table XI gives the record of excessive precipitation at all stations from which reports are received.

NOTES EXPLANATORY OF THE CHARTS.

Chart I.—Tracks of centers of high areas. The roman